VIRGINIA DEPARTMENT OF EDUCATION

Division of Technology

Web-based SOL Technology Initiative

Preliminary Architectural Guidelines for

High School Readiness

January 2001

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1 Purpose and Background

The purpose of this document is to provide *preliminary* information to Virginia school divisions that wish to begin purchasing equipment for participating in the Web-based SOL Technology Initiative.

On March 17, 2000, Virginia school divisions received preliminary notification that the General Assembly had forwarded House and Senate budget recommendations establishing funding for a statewide Web-based Standards of Learning Technology Initiative. This initiative was originally proposed by Governor Gilmore.

The intent of this initiative is to use Web-based systems to improve Standards of Learning *instructional*, *remedial*, and *testing* capabilities of high schools. Funding for this program is targeted to reach three general goals in each high school. These goals are:

- Creating Internet-ready local area network capability in every high school.
- Ensuring high schools have adequate high-speed, high bandwidth capability to meet instructional, remedial, and testing needs.
- Providing students access to computers on a ratio of one computer for every five students.

Detailed information on the initiative may be found on the Virginia Department of Education Web site at http://www.pen.k12.va.us/VDOE/Technology/soltech/soltech.html.

A Request for Proposals was developed and three vendors were selected to demonstrate their products in early 2001. These trials are known as the *Demonstration Projects*. One or more vendors will be selected to implement their product in Virginia high schools in 2003.

These preliminary guidelines are based upon the common elements among the selected proposals. *These guidelines are not to be interpreted as statewide standards.*

Upon completion of the demonstration projects in the spring of 2001, a more comprehensive version of the Architectural Guidelines will be published. Divisions should take steps to ensure that budgeted funds are spent to fulfill the minimum vendor requirements for facilities, network infrastructure, and computer platforms.

As explained in Superintendent's Memo No. 50, *"Submission of Plan for the Use of Funds for the Web-based Standards of Learning Technology Initiative"*, dated September 22, 2000, divisions are expected to resubmit their Plan for the Use of Funds periodically. Updates to the plan should include all expenditures made toward fulfilling the requirements of this initiative as defined in these guidelines and in the final version of the guidelines when it is published in late spring of 2001.

"Plan for the Use of Funds" submissions are scheduled for February 15, 2001 and monthly thereafter.

2 Recommendations

The Virginia Department of Education suggests, initially, focusing on upgrading facilities and the local area network (LAN). Priority should be been given to facilities for two reasons. First, providing adequate facilities is critical to the success of any networking infrastructure, and second, additional time is needed for the results of the demonstration projects to be incorporated into the guidelines. Wide area networking (WAN) and procuring workstations would then be addressed in subsequent phases as those requirements are defined.

2.1 Facilities

- All infrastructure projects must comply with appropriate building codes.
- Schools must ensure that they have electrical service sufficient to support additional devices to be used for instruction, remediation, and assessment.
- The testing location(s) will need electrical outlets sufficient to support additional devices to be used for testing.
- Servers and networking components (e.g., switches, routers etc.) should be stored in secured, climate-controlled area. Utilize racks or cabinets to alleviate space constraints, these are usually provided by cable or hardware vendor. Do NOT share the wiring closet with janitorial supplies. Corrosive chemicals, mop handles, and humidity can cause significant damage.
- File servers should be plugged into an uninterruptible power supply (UPS). Schools may also use a UPS for voice systems. Minimally, 30 minutes of battery backup should be provided for these systems. Preferably, in a power outage, the UPS would automatically shut down the servers in a controlled manner.
- All network equipment (e.g., routers, switches etc.) should be plugged into a UPS. Fifteen minutes of battery backup is generally sufficient.
- All network equipment and computer workstations should be plugged into an electrical surge suppression device. Such a device should also be installed on all copper cabling (e.g., analog telephone lines, DID and DOD trunk lines, etc.) at the demarcation “demark” point inside the building.
- Adequate space should be provided for a technician to have easy access to the front and rear of network equipment and servers.

2.2 Local Area Network (LAN)

- Remove Token Ring and migrate to an Ethernet topology.
- Replace thin net (10Base-2) with unshielded twisted pair (UTP) cabling.

- New cable installations should use Category 5e UTP or fiber optic cabling. Where possible, replace coaxial backbone cables with fiber optic cabling. Priority should be given to cables run between buildings. When feasible, install redundant cables and consider routing these cables along a separate path.

- All connecting hardware (e.g., patch cables, patch panels, and wall jacks etc.) also must be certified by the manufacturer or cabling contractor.

- Standardize on TCP/IP as the network protocol. Remove unneeded protocols and services from the workstations and servers.

- Replace shared hubs with 10/100 Ethernet switches. Schools should wait until the connectivity requirements are finalized to evaluate shared media solutions (e.g., wireless).

- Do not use network servers and other software applications to route traffic. Use routers, switches, or enhanced firewalls to segment and route network traffic.

- Define a scheme for naming and assigning addresses to each device on the network. Names should follow geographical boundaries or function. Use private (i.e., not assigned to anyone on the Internet) IP addresses.

- To improve name resolution and manageability, implement DNS (Domain Name Service) at the school level. Consider using DHCP (dynamically assigned IP addresses).

- Create a mechanism for managing the network and capturing performance statistics.

- Document the network infrastructure using an accurate copy of the building's blueprints.

2.3 Wide Area Network (WAN)

- Whether it is provided via the district or obtained directly, the Web-based SOL Technology Initiative requires each school to have a network connection to the Internet.

- When the district provides the Internet connection to schools, care must be taken not to over allocate the Internet connection.

- The Internet connection speed required by the Web-based SOL Technology Initiative will vary depending on the size of a school and other factors. Each school should arrange to have a T-1 line installed and purchase hardware upgrades that support this service. A T-1 line can support speeds from 128kbps to 1.544mbps. Schools may find it advantageous to contract for only a portion of the supported bandwidth (such as 512kbps or *"Fractional T-1"*) until the need for additional bandwidth is identified.

- To help alleviate bandwidth constraints, consider installing Web-caching devices in a secured area at the school.

- Your ISP (Internet Service Provider) should provide reports or a Web site that can be used to verify that bandwidth requirements are being met. Most network management packages can check these connections at regular intervals and provide a trend analysis. If those options are not available, several Web sites offer rudimentary testing capabilities.

- Each of the SOL testing Web sites uses some form of encryption. Ensure policy and/or firewall permit access to secured Web sites.

- Each network needs to be protected from the public Internet using a firewall or other technology. Preferably, some combination of these options could be used.

2.4 Computing / Workstation Platforms

These guidelines have not been finalized. Schools should not surplus existing PC hardware equipment until the demonstration projects are complete. Additional information will be provided after the vendor or vendors have been selected for statewide implementation. However, there are a few general guidelines to follow when purchasing these devices.

  - School divisions should purchase widely available computing platforms with the most powerful components they can afford in order to increase the useful life of the device.

  - Hardware for both servers and workstations should be procured from major providers or their designated representatives. These providers use commercial grade components with lower failure rates, but more important, they provide greater consistency in product offerings. Over time, a consistent product base will significantly reduce administration and support.

  - Consider the extended on-site warranty options when selecting a vendor or vendors.

- The minimum hardware requirements currently needed for testing on IBM compatible PCs are: Pentium 166MHz, 32MB RAM, 800x600-video resolution, standard keyboard and pointing device. Administering the test site has slightly higher requirements: Pentium 233MHz, 63MB RAM, remaining items are identical. Windows 9x, Windows NT 4.0 and Windows 2000 are supported.

- The minimum hardware requirements currently needed for testing on the Macintosh platform are: Mac OS 8.5 or later with PowerPC, 200Mhz, 32MB RAM or PowerPC 604 or G3, with 48MB RAM, 800x600-video resolution, standard keyboard and pointing device.

- Each workstation used for testing must have an Internet browser. The SOL test Web sites support: Netscape version 4.x and above or Internet Explorer version 5.x and above.

- Update essential software applications and device drivers (e.g., virus scanners, network card software and operating system patches etc.).

- Develop a means to identify and backup critical applications and servers.

3 Summary

While it is important to create and adhere to standards, VDOE recognizes each location will have unique requirements. Schools should survey the local environment and use the survey to develop an upgrade plan.

Before installing new or upgrading networking infrastructures, schools are encouraged to consult with professional network designers. These designers can develop a comprehensive network design that takes into account testing and other requirements as identified by the school or SOL assessment vendors. Once that design has been developed, it can be implemented in phases as funding and other constraints permit.

Upon completion of the demonstration projects in the spring of 2001, a more comprehensive version of the Architectural Guidelines will be published. Divisions should take steps to ensure budgeted funds are spent to fulfill the minimum vendor requirements for facilities, network infrastructure, and computer platforms.

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